important hydroxyl group, readily form mixed crystals. That a definite law does not hold in such cases is shown by the fact that phenol and hydroquinone, which bear the same relation to each other as phenyl salicylate and salicylhydroquinone, are not perceptibly isomorphous. The results are of importance as indicating a limitation of the cryoscopic method of determining molecular weights.

SOME experiments which are of importance from the standpoint of the theory of dyeing are described in the *Proceedings* of the Vienna Academy of Sciences (No. 15) by Prof. W. Suida. On exposing several finely divided natural silicates to the action of coal-tar dyes, it was found that those silicates which were of an acid nature, containing free hydroxyl groups, were permanently dyed by the basic dyes of this series, whilst acid dyes were without action. Similarly, hydrated silicic acid readily absorbs the same colours, whilst silicic anhydride has no affinity for them. When kaolin is used, the different colour-bases combine with it in equivalent proportions, probably to form colour-salts, the original acid in the dye becoming attached to constituents of the clay. Similar results were obtained with potato-starch, and the general conclusion is drawn that the process of dyeing with basic colours is far more chemical than physical in its nature.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN OCTOBER :—

Oct. 1. 7h. Mercury at greatest elongation, 17° 54′ W.
5. 7h. 45m. to 9h. 7m. Transit of Jupiter's Sat. III.
7. 15h. Moon in conjunction with Mercury. Mercury 1° 1′ N.
12. 11h. 0m. to 12h. 24m. Transit of Jupiter's Sat. III.
15. Venus. Illuminated portion of disc = 0·897, of Mars = 0·956.
18. 11h. 0m. Jupiter in opposition to the Sun.
19. 14h. 13m. to 15h. 42m. Transit of Jupiter's Sat. III.
19–21. Epoch of October meteors (Radiant 92° + 15°).
19. 10h. 8m. Minimum of Algol (β Persei).
22. 6h. 57m. Minimum of Algol (β Persei).
23. 10h. 0m. Moon in conjunction with Jupiter. Jupiter 1° 34′ N.
25. 6h. 37m. Jupiter's Sat. IV. in superior geocentric conjunction.
26. 16h. 48m. to 17h. 25m. Moon occults γ Tauri (mag. 3·9).

EXPLANATION OF THE MARTIAN AND LUNAR CANALS.—Prof. W. H. Pickering, writing to No. 7, vol. xii., of *Popular Astronomy*, offers an explanation of the formation and variation of the Martian canals which is based on their analogy to the similar features seen on the lunar surface. Whilst accepting the vegetal origin so ably supported by Mr. Lowell, Prof. Pickering finds the theory of artificial pumping suggested by that observer difficult to realise.

Instead of this, he supposes that the lunar canals, and hence, by analogy, those observed on Mars, are simply lines of volcanic action on the surface where the crust is weakened, and therefore is easily cracked by the internal stresses put upon it by the action of the heated interior.

This theory is supported by his observations that the canals, and also the lakes from which they appear to radiate, are dotted by small craterlets and are so symmetrically arranged about the craterlets as to suggest a causal relation between the two phenomena. Analogous formations are common in terrestrial volcanic districts; for example, in the 2000 mile stretch of volcanoes which occurs in the Andes.

This theory does not require the transference of water and carbon dioxide along the canals, but supposes that they issue directly from the interior along the whole length of each fissure, and in conjunction with sunlight promote the growth of vegetation. Owing to the rarity of the atmosphere, Prof. Pickering suggests that the vapours would not ascend on their emergence, but would quietly roll down the slopes of the craterlets, or "lakes," and canals, thereby sufficiently irrigating the immediate vicinity to produce the vegetation.

FURTHER OBSERVATIONS OF THE RECENT PERSEID SHOWER.—Communications from American observers confirm the comparative richness of the recent display of Perseids.

At Wilmington (N.C.) Mr. E. S. Martin saw between 25 and 30 Perseids per hour between 9 p.m. and 12 p.m. (local M.T.) on the nights of August 10 and 11, although very few were seen on August 12 and 13, and none on August 14.

At Barre (N.Y.) Mr. W. Wetherbee saw 154 meteors, of which 116 were Perseids, in less than three hours on the eve of August 11. He remarked that many of the Perseids appeared in pairs the components of which travelled in parallel paths and had equal magnitudes. According to this observer, the radiant has moved westward, and appeared to be near to the star ι Persei. One extraordinarily bright Perseid appeared in Aquila, and left a trail 10° long which lasted for about four minutes (*Popular Astronomy*, No. 7, vol. xii.).

POSITION OF SATURN'S NINTH SATELLITE.—A telegram from Prof. E. C. Pickering, published in No. 3969 of the *Astronomische Nachrichten*, announces that Prof. Barnard observed Phœbe, Saturn's ninth satellite, on September 12·6916 (G.M.T.). The apparent position at that time was as follows :—

$$\alpha = 21\text{h. } 12\text{m. } 29{\cdot}5\text{s.}, \quad \delta = -17^\circ\ 25'\ 55''.$$

The motion of the satellite was south-west, whilst the magnitude was 16·7.

DISTRIBUTION OF NEBULÆ IN RELATION TO THE GALAXY.—In No. 3969 of the *Astronomische Nachrichten* Dr. C. Easton discusses the distribution of the nebulæ in regard to the galactic system.

Commencing with the usually accepted statement that the nebulæ not only occur some distance from the Milky Way, but that they actually tend to congregate about the galactic poles, he confirms this, from observational data, for the northern hemisphere, but questions its truth for the southern hemisphere. He further states that the accepted notion that it is simply the lack of observations which accounts for the apparent scarcity of nebulæ in the southern hemisphere is not founded on fact. If it were true, then that part of the northern galactic zone which lies south of the equator should apparently contain fewer nebulæ than that part which is above, because it has not been so well observed. The following figures show that although this is true for the faint nebulæ, which with the planetary nebulæ are placed in the category of "green nebulæ," in the case of the bright (*i.e.* "white") nebulæ the inverse is true :—

Northern Galactic Zone.

	A S. of the equator	B N. of the equator
Faint nebulæ ...	... 754 ...	... 1043
Bright nebulæ ...	... 152 ...	... 71

This leads to the conclusion that the nebulæ in the southern hemisphere are not arranged in the same manner as those in the northern.

Several other interesting points are developed by Dr. Easton in his paper, and are supported by the tabulated observational results which he gives. One other important conclusion at which he arrives is that the faint nebulæ are allied, as regards their phase of development, to the stellar conglomerations of the galaxy and occur in the same regions, whilst the bright (*i.e.* "true") nebulæ are similarly allied to the sparsely distributed non-galactic stars.

ASTRONOMY AND COSMICAL PHYSICS AT THE BRITISH ASSOCIATION.

GREAT vitality was shown in this subsection, and three mornings and one afternoon were hardly sufficient to get through the rather large programme. The meetings were well attended, and were of particular interest, since many distinguished foreigners were present, several of whom attended at Cambridge in consequence of the meeting there of the subcommittee of the International Meteorological Committee which was appointed at Southport last year to discuss the means of advancing our knowledge of the relation between solar and terrestrial changes.

Sir John Eliot's address has already appeared in these columns, so that attention here will be restricted to the subsequent proceedings of the subsection.

With Sir John Eliot in the chair, the first paper on Friday was by Father Cortie, who summed up the results of all the observations of sun-spot spectra made at Stonyhurst during the period 1883–1901. One of the chief points of the paper was to show the great importance of the elements vanadium and titanium, the lines of these elements being more frequently widened than those of any other. Reference was also made to widened-line crossings and to oxygen in the spectra of sun-spots.

Sir Norman Lockyer then followed with a short summary of his work on the classification of stars according to their temperature since he gave the Rede lecture in 1871. The chief feature of the paper was to show that by paying special attention to the results obtained with a small camera having calcite and quartz to replace the glass lens and prism used in his earlier work, he was enabled to bring a more efficient check on the classification from the point of view of the extension of the spectrum in the ultra-violet than he could with the glass optical parts. The result of this inquiry confirmed the chemical classification in every respect.

The extension in the ultra-violet part of the spectrum as a criterion of stellar temperatures was the subject of a paper by Mr. H. F. Newall, who was inclined to question this criterion based upon the ultra-violet extension. He referred to observational evidence, which displayed sometimes perplexing discrepancies between the relative intensities of the blue and the red ends of the spectrum in different stars. The point raised was, how far was the present criterion of stellar temperature based upon the observed behaviour of gaseous radiation as opposed to the radiation of solid bodies? He said, in conclusion, that it was not impossible that we should be forced to regard extension in the ultra-violet regions as a sign of differences and not of high temperature.

The paper on the short-period barometric see-saw and its relation to rainfall, by the present writer, was an extension of a paper which has previously been printed in this Journal (vol. lxx. p. 177). The chief point was to show how very closely rainfall curves were associated with curves representing the inverted barometric changes. The regularity of the barometric see-saw mentioned above suggested that there may possibly be found to exist a method here of forecasting wet and dry years over a large portion of the earth's surface.

After a brief interval for lunch, the meeting was continued, Dr. Shaw taking the chair in the absence of Sir John Eliot.

Prof. Birkeland (Christiania) spoke about the relationship between sun-spots and auroræ. The chief feature was to indicate that "stream lines" from the sun could only reach the earth's atmosphere between very narrow limits, and these in high latitudes, and further that only spots on a restricted portion of the solar disc in relation to the position of the earth would have any terrestrial effect. In this way he suggested a means of explaining the narrow curtain-like form of the aurora and its occurrence chiefly in high latitudes.

A short paper by M. Angot (Paris) described a result which he had derived from an examination of Wolf's sun-spot numbers. He found that, by taking the relative number at a sun-spot minimum and also about a sun-spot maximum, small relative numbers at a minimum are followed by small numbers at a maximum, and large numbers at a minimum by large numbers at a maximum. As the last minimum (1901·7) was small, the next maximum, he suggested, will be small also. As another investigation points to the next maximum being comparatively large, it will be interesting to see which occurs.

The results of an investigation of the upper air over the Mediterranean by means of flying kites from a steamer were described by M. Teisserenc de Bort. He showed that although on the average greater elevation meant greater wind velocity, there were alternately strata of large and small velocities. This fact explains why sometimes attempts at getting kites to fly above certain elevations have failed. Both Mr. Rotch and Dr. Shaw spoke on this interesting question.

Commander Hepworth described the relation between pressure, temperature, and air circulation in the South Atlantic Ocean, the result of a large piece of research work in which 3300 ships' logs had been utilised. In the absence of Prof. K. Ångström, his two papers, on the ultra-violet absorption spectrum of ozone and the existence of that gas in the atmosphere, and an instrument for the measurement of the radiation from the earth, were taken as read, and the meeting closed for the day.

On Monday, the second day on which this subsection met, Sir J. Eliot being in the chair, the reports of the seismological and kites committees were briefly summarised by Dr. Milne and Dr. Shaw respectively.

Mr. A. L. Rotch (U.S.A.) described the results of the experiments he has been making with kites at the Blue Hill Observatory in order to determine the temperature of the air in cyclones and anticyclones. Sir David Gill spoke about an attempt he had made to state the problems in practical astronomy which press for solution. Among these he mentioned the apparent discordance between the value of the constant of aberration as derived from direct observation (20″·52) and that obtained by combining the measured value of the sun's parallax (8″·80) with the known velocity of light, which gives a value of the aberration constant (20″·48). The discussion in the paper confined itself to the means to be adopted for perfecting the determinations of the solar parallax, the constant of aberration, and the mass of the moon. Reference was also made to the variation of latitude, to the Lœwy-Comstock method for determining the aberration constant, to recent improvements in methods of meridian observation, and to the value of old series of observations.

Dr. W. N. Shaw opened the discussion on a memorandum adopted by the committee of the council on the suggested uniformity of units for meteorological observations and measurements. Several speakers gave their views on the subject, but no definite conclusion was arrived at. The general opinion seems to be that either to alter or put additional scales to the barometers and thermometers would, from a practical point of view, be detrimental to the observations themselves. It was suggested that such units might be adopted in the discussion of meteorological problems, the conversions to the new scales being made after the observations had been collected at the central office. From the physical standpoint the subject was not discussed.

In a paper on the masses of stars, Dr. H. N. Russell pointed out that the average mass of fifty-five binary stars is about three times that of the sun. Groups of stars with very different spectra, magnitudes, and proper motions have almost the same average mass. Thus it was concluded that stars vary much less in mass than in other characteristics.

The third and last meeting of this subsection took place on Wednesday, Sir John Eliot being in the chair. The first two items on the programme were the reports of committees on the Falmouth Observatory and on observations of Ben Nevis. In the absence of Prof. O. Backlund (St. Petersburg), his paper on some results of researches on the comet Encke was taken as read.

The writer described briefly the spectroheliograph recently erected at the Solar Physics Observatory, South Kensington. This instrument, which is now in fair adjustment, is used for photographing the sun in monochromatic light. The numerous photographs shown gave an idea of the efficiency of the instrument, and they are now being daily secured, weather permitting. Composite pictures in "K" light were shown, the "limb" and "disc" of the sun being taken on one plate. Many of the photographs showed rapid solar changes,[1] one enormous prominence 192,000 miles in length increasing to 216,000 miles in five hours, its height changing from 55,000 miles to 60,000 miles simultaneously.

In a paper on the unsymmetrical distribution of rainfall about the path of a barometric depression, Dr. H. R. Mill showed that, for the British Isles, the area of heavy rainfall, in nine cases out of ten, lay on the left of the cyclone's path, and in advance of the centre. This relationship suggests that a more definite basis for forecasting heavy rains becomes available if it be possible to ascertain previously the path of the cyclone's centre.

Miss Hardcastle read Miss F. E. Cave's paper, which contained some further results she has obtained relative to the application to meteorology of the theory of correlation. The two stations taken were Wilmington (North Carolina) and Halifax (Nova Scotia), distant from one another about 1000 miles. Allowing different intervals between the corresponding barometric observations, the magnitude of the correlation was found to vary with these intervals, being greatest when Halifax is taken one day later than Wilmington. It was suggested that for selected places further apart the discovery of correlations of sufficient magnitude might be of use in the practical work of prediction.

Major B. Baden-Powell described briefly the development of the aëroplane, and gave an account of the experiments that he has been recently carrying on. Chief among these were his gliding experiments made at the Crystal Palace, in which he is seeking to find out how a man-carrying machine behaves while travelling in the air.

After a paper by Prof. D'Arcy W. Thompson on Plato's theory of the planets, the business of the subsection came to a conclusion, the following papers being taken as read:—Report of Committee on Underground Temperatures; Dr. F. Hirtel, Zur Flugfrage; Rev. J. M. Bacon, upper air currents and their relation to the audibility of sound; Prof. Lemström (Helsingfors), on the effect of electric air-currents; J. Hopkinson, the rainfall of the midland and eastern counties of England, and the rainfall of England, 1861–1900.

WILLIAM J. S. LOCKYER.

ZOOLOGY AT THE BRITISH ASSOCIATION.

THE meetings of Section D were held in the new Sedgwick Museum of Geology. On Thursday morning, August 18, Mr. W. Bateson, F.R.S., delivered to a large audience his presidential address (see NATURE, August 25), the vote of thanks for which was moved by Prof. Poulton and seconded by Prof. Max Weber. In the afternoon Prof. F. W. Keeble gave an address, illustrated with diagrams and lantern slides, on the coloration of marine Crustacea, embodying results of the researches carried on by Dr. Gamble and himself during the last seven years. He described the prawn-like ***Hippolyte varians*** which lives among the seaweeds around our coasts, and matches their colour with marvellous precision. Its colours range through green, yellow, and brown to red. When given a choice between different coloured weeds, this animal invariably picks out for its abiding place that weed which is in harmony with its own coloration, a faculty to be ascribed not to the possession of a colour sense by the animal, but rather to an extreme sensitiveness to light. Only in one position, namely, on weed of its own colour, is it in a position of light equilibrium, and then it rests. The coloration of the animal is produced by the manipulation of its three colour pigments, red, yellow, and blue. The common shrimp and prawn were shown to possess the same mechanism, although they make little use of it. Transparent young Hippolytes placed on weed of a certain colour develop the pigment necessary to approximate the animals to that colour in forty-eight hours or less; older animals take almost a week for the same process, and adults a fortnight, but even then the result is imperfect. Though the adults have lost, to a large extent, this power of sympathetic colour change, the pigments react rapidly to changes of light. This reaction is most marked not when the intensity of light changes, but when the background on which the animal rests is changed from white to black, *i.e.* from one which scatters to one which absorbs light. In the daytime the pigments are expanded; at night they are contracted, except the blue, so that the animal has then a transparent azure colour. This is a true periodic change; it has become a habit, and endures for days even though the animals be kept in darkness.

Prof. W. B. Scott, of Princeton, U.S.A., then delivered an address (with lantern illustrations) on the Miocene ungulates of Patagonia The animals described were collected by the Princeton Expedition from the Santa Cruz beds, the Miocene age of which seems to be now established. Prof. Scott pointed out that while these South American ungulates are singularly different (especially in the structure of the periotic region) from those of the northern hemisphere, it is not unlikely that they have a common origin, as Ameghino has described a number of genera from pre-Patagonian formations which, though incompletely known, appear to be referable to the Condylarthra—the parent stock of the northern ungulates. Very probably an early Eocene or late Mesozoic migration carried the Condylarthra into South America, and there, in almost complete isolation, they gradually gave rise to the various peculiar orders of the Noto-Ungulata. The possibility of such a migration is shown by the discovery of an armadillo in the Middle Eocene of North America.

The section was occupied practically the whole of Friday, August 10, with papers and discussions on heredity, Prof. Hickson, F.R.S., in the chair.

The first paper was by Miss E. R. Saunders on heredity in stocks. She said that since the re-discovery of Mendel's work, experimental evidence of the purity of the germ cells has been found in a rapidly increasing number of examples. Much of this evidence has been derived from cases like those studied by Mendel where the differentiating characters are related to each other as dominant and recessive. In such cases the individuals of the (F_1) first generation (DR) show the dominant character, and those of the second (F_2) generation the two parental characters in the ratios 3 D : 1 R or 1 D : 1 R, according as they result from DR×DR or DR×R. In other cases the results are complicated by reversion, gametic coupling of distinct characters, &c., and they require careful analysis, and several generations may be required to elucidate them. As a surface character hoariness is dominant, glabrousness recessive. Experiments in the form DR×DR or DR×R, where D is the white-flowered form of *Matthiola incana* and R a glabrous ten-week strain, give normal Mendelian ratios in F_2. In other cases the result, as regards hoariness and glabrousness, is more complex, owing to the different behaviour of various glabrous strains, which, as far as can be seen, differ only in *flower colour*. As to flower colour, various combinations of colours give reversionary purple in the first generation (F_1). Purple F_1 may also be produced by two white parents if they belong to strains differentiated by the leaf surface. Such purple cross-breeds may give a simple Mendelian result in F_2, or a variety of new colour forms may appear, this latter being commonly seen when cream is one of the parental colours. For example, in a cross of a glabrous white with a glabrous cream, at least nine colour forms were produced in F_2. Whether the appearance of these new forms indicates disintegration or simply re-combination of preexisting characters is uncertain. Creams breed pure at once. Some whites are pure, others are heterozygotes with cream. The number of extracted recessive types resulting from a given union and their specific behaviours are not yet known.

Mr. A. D. Darbishire gave some account of his experiments on the breeding of mice. The Japanese waltzing mice show the well known restless and spinning movements; they have a piebald yellow and white coat and pink eyes. When an albino is crossed with a Japanese waltzing mouse the majority of the offspring are on first inspection indistinguishable from the common house mouse, and they invariably (in all the 300 cases bred) have black eyes. Hybrids never exhibit waltzing movements, and they are never albinos. When such hybrids are bred together they produce offspring which, considered from the point of view of colour, fall into three categories:—(1) those (half the number) with black eyes and coloured coat, and therefore resembling their parents; (2) those (one-fourth) with pink eyes and coloured coat, therefore presenting the same features of eye- and coat-colour as Japanese waltzers; (3) those (one-fourth) with pink eye and uncoloured coat, *i.e.* albinos. About one-quarter of these hybrids waltz, but the rest are normal in their progression, and the waltzing habit may be associated with any of the three colour categories. The albinos (group three) breed true, the pink-eyed mice with coloured coats breed nearly true, and the black-eyed mice with coloured coats produce, when paired together, albinos, pink-eyed mice with coloured coats, and black-eyed mice with coloured coats (proportions of each not yet determined). Some of the facts seem to confirm the Mendelian interpretation, while others may be described in terms of either Galton's or Pearson's formulæ of ancestral inheritance.

Mr. C. C. Hurst described some experiments on heredity in rabbits. An inbred pair of albino Angoras was crossed